

AMENDMENTS TO THE CLAIMS

Claims 1-3 (Cancelled)

4. (Withdrawn) The tunnel-injection device of claim 2, wherein conductivity type of the carrier-supplying region is same as the barrier-forming layer.

5. (Withdrawn) The tunnel-injection device of claim 2, wherein impurity-doping level of the carrier-supplying region is higher than the barrier-forming layer.

6. (Withdrawn) The tunnel-injection device of claim 1, wherein the reception layer comprises;

a heavily doped region being metallurgical contacting with the barrier-forming layer; and
a drift layer having impurity-doping level lower than the heavily doped region, being in metallurgical contact with the heavily doped region, configured to transport the carrier to the drain region.

7. (Withdrawn) The tunnel-injection device of claim 1, wherein the carrier-supplying region being stacked on the barrier-forming layer.

Claims 8-9 (Cancelled)

10. (Withdrawn) The tunnel-injection device of claim 1, wherein gate insulating film contacts with the top surface of the reception layer in a window part of the barrier-forming layer being buried in the reception layer.

11. (Withdrawn) The tunnel-injection device of claim 10, wherein the carrier-supplying region is buried in the barrier-forming layer so that the gate insulating film can cover simultaneously the top surfaces of the reception layer, the barrier-forming layer and the carrier-supplying region.

12. (Withdrawn) The tunnel-injection device of claim 1, wherein gate insulating film is spatially isolated from the top surface of the reception layer by the barrier-forming layer being laminated on the top surface of the reception layer.

13. (Withdrawn) The tunnel-injection device of claim 12, wherein gate insulating film contacts with the top surface of the barrier-forming layer in a window part of the carrier-supplying region being laminated on the top surface of the barrier-forming layer.

14. (Withdrawn) The tunnel-injection device of claim 12, wherein gate insulating film cover both the top surface of the barrier-forming layer and the top surface of the carrier-supplying region in a substantially same planar level.

15. (Withdrawn) The tunnel-injection device of claim 1, wherein the carrier-supplying region comprises the first semiconductor.

16. (Withdrawn) The tunnel-injection device of claim 15, wherein the carrier-supplying region is buried in the reception layer.

17. (Withdrawn) The tunnel-injection device of claim 16, wherein the barrier-forming layer cover simultaneously the top surfaces of the reception layer and the carrier-supplying region.

18. (Withdrawn) The tunnel-injection device of claim 16, further comprising a body region made of the first semiconductor having an opposite conductivity type of the reception layer, wherein the carrier-supplying region is disposed on the body region.

19. (Withdrawn) The tunnel-injection device of claim 16, wherein the carrier-supplying region serves as a source region of the insulated gate transistor.

20. (Previously Presented) A method for fabricating a tunnel-injection device, comprising:

preparing a substrate made of a first semiconductor;

homo-epitaxially growing a first layer made of the first semiconductor on a surface of the substrate;

forming a pattern of an insulating film having a first window portion exposing partially a surface of the first layer;

growing a second layer made of a second semiconductor having a bandgap energy narrower than the first semiconductor on the insulating film and, through the first window portion, on the surface of the first layer so as to form a heterojunction interface between the first and second semiconductors;

doping selectively first impurity atoms in the second layer above the first window portion so as to form a barrier-forming layer made of the second semiconductor, the barrier-forming layer forms a band-edge discontinuity barrier for a tunneling injection of carriers at the heterojunction interface;

doping selectively second impurity atoms with heavier doping level than the barrier-forming layer in the second layer above the insulating film so as to form a carrier-supplying region made of the second semiconductor, configured to supply carriers to the barrier-forming layer;

removing selectively a part of the second layer doped with the first impurity atoms so as to form a second window portion exposing partially the surface of the first layer;

depositing a gate insulating film on the barrier-forming layer and, through the second window portion, on the surface of the first layer so as to contact with the heterojunction interface;

forming a gate electrode on the gate insulating film, the gate electrode is configured to change a tunneling probability of the carriers, which are configured to be injected into the reception layer by tunneling through the band-edge discontinuity barrier, by controlling a width of the band-edge discontinuity barrier; and

forming a source electrode on the carrier-supplying region.

Claims 21-24 (Cancelled)

25. (Currently Amended) ~~[[The]]~~ A tunnel-injection device ~~of claim 1, further~~ comprising:

a drain region made of a substrate of a first semiconductor;

a reception layer made of the first semiconductor disposed on and metallurgically contacted with a top surface of the drain region;

a barrier-forming layer made of a second semiconductor having a bandgap energy narrower than the first semiconductor, being in metallurgical contact with the reception layer so as to form a band-edge discontinuity barrier by a heterojunction interface between the first and second semiconductors;

a gate insulating film disposed on the barrier-forming layer contacting to the heterojunction interface;

a gate electrode disposed on the gate insulating film configured to change a tunneling probability of the carriers, which are configured to be injected into the reception layer by tunneling through the band-edge discontinuity barrier, by controlling a width of the band-edge discontinuity barrier;

a carrier-supplying region made of the second semiconductor, being contacted with the barrier-forming layer, configured to supply the carriers to the barrier-forming layer;

a source electrode being contacted with the carrier-supplying region; and

an insulating film disposed at a limited area of and on a top surface of the reception layer.

26. (Previously Presented) The tunnel-injection device of claim 25, wherein the carrier-supplying region is disposed only on the insulating film.

27. (Previously Presented) The tunnel-injection device of claim 26, wherein the carrier-supplying region is laterally contacted with the barrier-forming layer so as to form junction interface between the carrier-supplying region and the barrier-forming layer on the insulation film.

Claims 28-29 (Cancelled)

30. (Previously Presented) A tunnel-injection device, comprising:
a reception layer made of a first semiconductor;
an insulating film disposed at a limited area of and on a top surface of the reception layer;
a barrier-forming layer made of a second semiconductor having a bandgap energy narrower than the first semiconductor, being disposed at another limited area of and on the top surface of the reception layer, forming a band-edge discontinuity barrier by a heterojunction interface between the first and second semiconductors;
a gate insulating film disposed at still another limited area of and on the top surface of the reception layer, being contacted with the barrier-forming layer;
a gate electrode disposed on the gate insulating film configured to change a tunneling probability of the carriers, which are configured to be injected into the reception layer by tunneling through the band-edge discontinuity barrier, by controlling a width of the band-edge discontinuity barrier; and

a carrier-supplying region made of the second semiconductor, disposed only on the insulating film, being laterally contacted with the barrier-forming layer, configured to supply the carriers to the barrier-forming layer.

31. (Cancelled)